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Art. IV.—*Victorian Graptolites (New Series), Part II.*

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(With Plates I. and II.)

[Read 16th April, 1925.]

Some years ago, when working on the Palaeozoic rocks of the Gisborne district, Mr. W. Crawford and the writer discovered, among other outcrops of fossiliferous rocks, one north of Gisborne, from which we recorded (1) :—

Didymograptus caduceus, Salter.
Didymograptus sp.
Tetragraptus quadribrachiatus, J. Hall.
Diplograptus sp.
Climacograptus sp.
Glossograptus sp.
Cryptograptus tricornis, Carruthers sp.
cf. *Cardiograptus* sp.
Trigonograptus ensiformis, J. Hall sp.
Loganograptus cf. *logani,* J. Hall sp.
Phyllograptus sp.
cf. *Thamnograptus* sp.

The comment was made that the finding of *Cryptograptus tricornis* and the common occurrence of *Diplograptus* at the Gisborne outcrop would place it very high in the Lower Ordovician, and that it might be the highest bed yet recognised. A somewhat similar association was found at Woodend, where a small outcrop of decayed shale yielded the first seven forms mentioned above, with the doubtful exception of *D. caduceus.* Many new forms from these beds were put aside for further examination as they presented unfamiliar features. In 1924 Mr. A. T. Woodward, of Bendigo, discovered at Bendigo East fossiliferous shales with a Darriwil fauna, and he has been kind enough to permit the writer to study the graptolites he has collected, and also to examine the area in company with him. The general association of graptolites at one outcrop at Bendigo East seems to be the same as that of the Gisborne locality already referred to. Among forms collected were :—

Didymograptus caduceus, Salter.
Tetragraptus quadribrachiatus, J. Hall.
Diplograptus coelatus, Lapworth sp.
Glossograptus spp.
Climacograptus sp.
Cryptograptus tricornis, Carruthers sp.
Cardiograptus crawfordi, sp. nov. (identical with cf. *Cardiograptus,* supra).

Lasiograptus sp.
Trigonograptus ensiformis, J. Hall sp.
Atopograptus woodwardi, gen. et sp. nov.

This association has thrown further light on the Gisborne material. The specimen of *Didymograptus caduceus* from Bendigo East is a paracmic form with comparatively narrow and parallel stipes, but presents no other special features.

The species common to the Gisborne and East Bendigo outcrops which are dealt with in this paper are:—

Didymograptus nodosus, sp. nov.
Cardiograptus crawfordi, sp. nov.
Cryptograptus tricornis, Carruthers sp.
Atopograptus woodwardi, fam., gen., et sp. nov. (representative of a new family of Graptoloidea—Atopograptidae).

Didymograptus nodosus, sp. nov.

(Plate I., Figs. 1-4.)

Description.—Rhabdosome small. Sicula not large, but conspicuous, nearly 1 mm. long, narrow in proportion to its length. Stipes arising sub-orally, and diverging at an angle of 135-145°, widening gradually, in typical specimens less than 10 mm. long. Thecae 11-12 in 10 mm., of peculiar shape, being apparently slightly curved rectangular tubes, each arising from the preceding theca at a point a little more than half way along its dorsal margin, then running parallel with that theca and continued beyond its aperture. Each theca appears, therefore, to bud directly from its predecessor in such a way that a common canal as distinct from the thecal cavity is indistinguishable. Thecae inclined at a low angle to the axis of the stipe—25° or less. Apertural margin straight and making an acute angle with the axis, its ventral angle acutely pointed.

Remarks.—This graptolite differs from a typical *Didymograptus*, but is provisionally retained in the genus. At first glance it appears as if each theca arises from the trumpet-shaped aperture of its predecessor, but closer examination shows that the two denticles which make the apparent trumpet are the aperture of one theca and the heel of its successor. The description is based on specimens from Gisborne found by Mr. W. Crawford and the writer while working on that area. At Bendigo East localities specimens with more loosely spaced thecae and a more robust aspect are common. This discovery was made too late to enable them to be figured.

Localities.—Not uncommon in the Upper Darriwil shales of Jackson's Creek, north of Gisborne. Very common in the Bendigo-Heathcote railway cutting, S.E. of the Wellsford Rifle Range, and along the main Bendigo-Heathcote road, Bendigo East.

CARDIOGRAPTUS CRAWFORDI, sp. nov.

(Plate I., Figs. 5-7.)

1921. cf. *Cardiograptus,* Proc. Roy. Soc. Vic., n.s., xxxiii., p. 55.

Description.—Rhabdosome, small, heart-shaped, the usual length being about 7 mm., with a breadth of 5 mm. Many specimens are smaller, but these proportions seem to be fairly constant. Sicula large, 2 mm. or more in length, but embedded in the rhabdosome in such a way that its exact measurement is doubtful. The first theca appears to arise sub-orally, and it and the succeeding thecae grow parallel to, and beyond, the aperture of the sicula. Later thecae gradually turn upwards until the most distal are inclined at an angle of 330° to the axis. Thecae, trumpet shaped tubes of the same type as in *D. caduceus,* in contact their whole length. Apertures concave, with a well developed denticle.

Remarks.—This form can be confused with at least three others—*Phyllograptus, Petalograptus,* and *Cardiograptus morsus.* From the first it is distinguished by the absence of the medial stipes and by the difference in shape between the two ends of the rhabdosome. From *Petalograptus* it is distinguished by the difference in position of the sicula and the direction of growth of the thecae. (The ovate end of a *Petalograptus* faces the opposite direction to the aperture of the sicula, in *Cardiograptus* it faces the same way). From *Cardiograptus morsus* it is distinguished by the smaller size, and by less pronounced emargination at the distal end. (This emargination, at first set down as a generic character of *Cardiograptus,* now seems to be specific only). From the young form of *C. morsus* it is barely distinguishable, but as it occurs at outcrops from which the typical *C. morsus* is absent, it appears worthy of specific rank. Its determination adds another name to the list of apparent derivatives from *D. caduceus.*

Localities.—Jackson's Creek, near the Pound, or old Agricultural Show Grounds, Gisborne; Sec. 95, Woodend; Bendigo East.

CRYPTOGRAPTUS TRICORNIS, Carruthers sp.

(Plate I., Figs. 8-10; Pl. II., Fig. 11.)

1858. *Diplograptus tricornis,* Carruthers, Roy. Phys. Soc. Trans. Edin., i., p. 468. (For further references, see Ruedemann, Grap. N.Y., pt. 2, pp. 443-444.)

Description.—Rhabdosome in most cases parallel-sided, less commonly tapering distally, typically 10 mm. long, varying in width according to the mode of preservation; aspect *a* with thecae showing, 2 mm. wide over all; aspect *b* turned 90° from *a,* 1 mm. wide. Sicula 1 mm. long, furnished with virgella and straight or

slightly curved lateral spines, which are conspicuous in forms of aspect *b*. Thecae 12-16 in 10 mm., about 1 mm. long, overlapping by about half, at first apparently growing in the same direction as the aperture of the sicula, but soon turning so that the aperture is directed towards the distal extremity as is usual among the Diplograpti. Both ventral and apertural margins are concave, and in most specimens it is impossible to distinguish them without assuming some definite plan of growth. Hence J. Hall figured forms in which he seems to make the apertures open towards the sicular end. In aspect *b* the thecae do not project beyond the parallel sides of the rhabdosome, but their positions are indicated by cross markings. Forms showing every angle of preservation between *a* and *b* may be found, and sometimes the mode of preservation varies in different portions of the same rhabdosome. The virgula is usually distinct, and often produced beyond the rhabdosome, this prolongation being sometimes dilated. In some specimens from Bendigo East the rhabdosome narrows somewhat towards the distal end.

Remarks.—"This most remarkable graptolite," as Dr. Ruedemann (2) calls it, is common both in Great Britain and in North America. J. Hall's sketches might be paralleled by drawings of Victorian specimens, as far as general appearance is concerned. As has been stated, the dimensions and form of the rhabdosome vary according to the direction of compression. The specimens collected by the writer differ from the American and British form in being usually shorter, slightly wider, and with more closely arranged thecae. The sicula is also shorter. As the general features of the rhabdosome closely resemble those of foreign examples, and, moreover, as Dr. T. S. Hall's specimens seem to have been narrower, even the cumulative effect of these differences does not appear to warrant the creation of a separate species. In fact, J. Hall's original drawings might well be supposed to represent Victorian specimens.

Ruedemann (2) states that "it is evident that this small, peculiar graptolite possessed not only a considerable range, and may have extended from the Chazy formation to the base of the Utica, but was well established in Trenton times in both the Atlantic and Pacific oceanic basins and their border seas as the Appalachian and Bohemian-Mediterranean basins." Both in America and Europe it ranges from our Lower to Upper Ordovician, and the same seems to be the case in Victoria. The Chazy formation may, perhaps, best be compared with the Victorian Upper Castlemaine and Darriwil series. At Woodend, Gisborne, Upper Macedon, and Bendigo East, *Cryptograptus* is found with Lower Ordovician forms, while elsewhere it is associated with *Dicellograptus* and other Upper Ordovician graptolites.

Localities.—North of Gisborne; Woodend; Cheniston (Upper Macedon); East Bendigo (Lower Ordovician).

Junction of Jackson's and Riddell's Creeks, (Ba 67); Toolern Creek; Djerriwarrh Creek; Glendoon Creek, and other Gisborne localities (Upper Ordovician). It has also been recorded by Dr. T. S. Hall from Upper Ordovician rocks at Tallong and Stockyard Creek, N.S.W.; and from Mt. Wellington, Mt. Easton, and the Jordan River, all in Northern Gippsland, Victoria.

Order GRAPTOLOIDEA Lapworth.

Family ATOPOGRAPTIDAE, nov.

Uniserial (and uni-biserial?) Graptoloidea, with straight (or flexed?) stipes. Thecae, tubular, with sigmoid ventral curvature and extroverted apertures.

The following summary shows the relation of this new family to other uniserial and uni-biserial graptolites:—

Dichograptidae ..	Thecae, simple sub-cylindrical tubes.
Leptograptidae ..	Thecae, elongated tubes with slight sigmoidal ventral curvature, apertures somewhat introverted, but not introtorted.
Dicranograptidae ..	Thecae, sigmoidally curved tubes, with apertures situated within depressions and often introverted and introtorted.
Atopograptidae ..	Thecae, sigmoidally curved tubes, with extroverted and sometimes extrotorted apertures.

Genus **Atopograptus**, gen. nov.

A uniserial form, with two stipes, in general outline resembling a *Didymograptus*, but with sigmoidally curved thecae with extroverted apertures. The type of the genus is *Atopograptus woodwardi*.

ATOPOGRAPTUS WOODWARDI, sp. nov.

(Plate II., Figs. 12-15).

Description.—Stipes diverging at an angle of 180°; in the only specimen known, each stipe is about 20 mm. in length and of uniform width throughout—about ·4 mm. over the centre of a theca, and ·7 mm. over the extroverted apertural region. Thecae 7 in 10 mm., of the type of *Monograptus nodifer*, Törnquist, inclined at a very low angle, in contact practically their whole length exclusive of the coiled apertural portion. This apertural region forms a conspicuous lobe which occupies one-half of the total width of the rhabdosome. The ventral margin of each theca shows a slight but distinct ogee curvature. Sicula not observed, but its position clearly indicated by the reversal of the thecae at a central point of the rhabdosome, and by the fact that the thecae immediately on each side of the point of reversal differ in length—2 mm. and ·7 mm.

Remarks.—This extraordinary graptolite was found by the writer while examining with Mr. Woodward the material thrown out from a small shaft at Bendigo East. Had its state of preservation been less perfect its interpretation would have been a matter of great difficulty. However, it is preserved as a mould in light-coloured shale, and the impression is so sharp that plasticene casts can be made without difficulty. There is, therefore, no doubt that it is a bilaterally symmetrical form, although its thecae are of a type hitherto only found among the Monograptidae. It is interesting as carrying back the lobate type of thecae to the Didymograptus stage; in other words it could popularly be described as a *Didymograptus* with lobate monograptid thecae.

Locality.—One well-preserved specimen from Bendigo East. On general evidence the beds are placed as high in the Darriwil series, Lower Ordovician.

LIST OF REFERENCES.

1. W. J. Harris and W. Crawford. *Proc. Roy. Soc. Vic.*, n.s., xxxiii., pp. 54, 55, 1921.
2. R. Ruedemann. Grap. New York, part 2, p. 446, 1908.

EXPLANATION OF PLATES.

I.

Fig. 1.—*Didymograptus nodosus*, sp. nov. Holotype. Lower Ordovician (Upper Darriwil). Jackson's Creek, north of Gisborne. [13355].*

Fig. 2.—*D. nodosus*, sp. nov. Paratype. Lower Ordovician (Upper Darriwil). Jackson's Creek, north of Gisborne. [13353].

Fig. 3.—*D. nodosus*, sp. nov. Paratype. Fragment showing nature of thecae. Lower Ordovician (Upper Darriwil). Jackson's Creek, north of Gisborne. [13354].

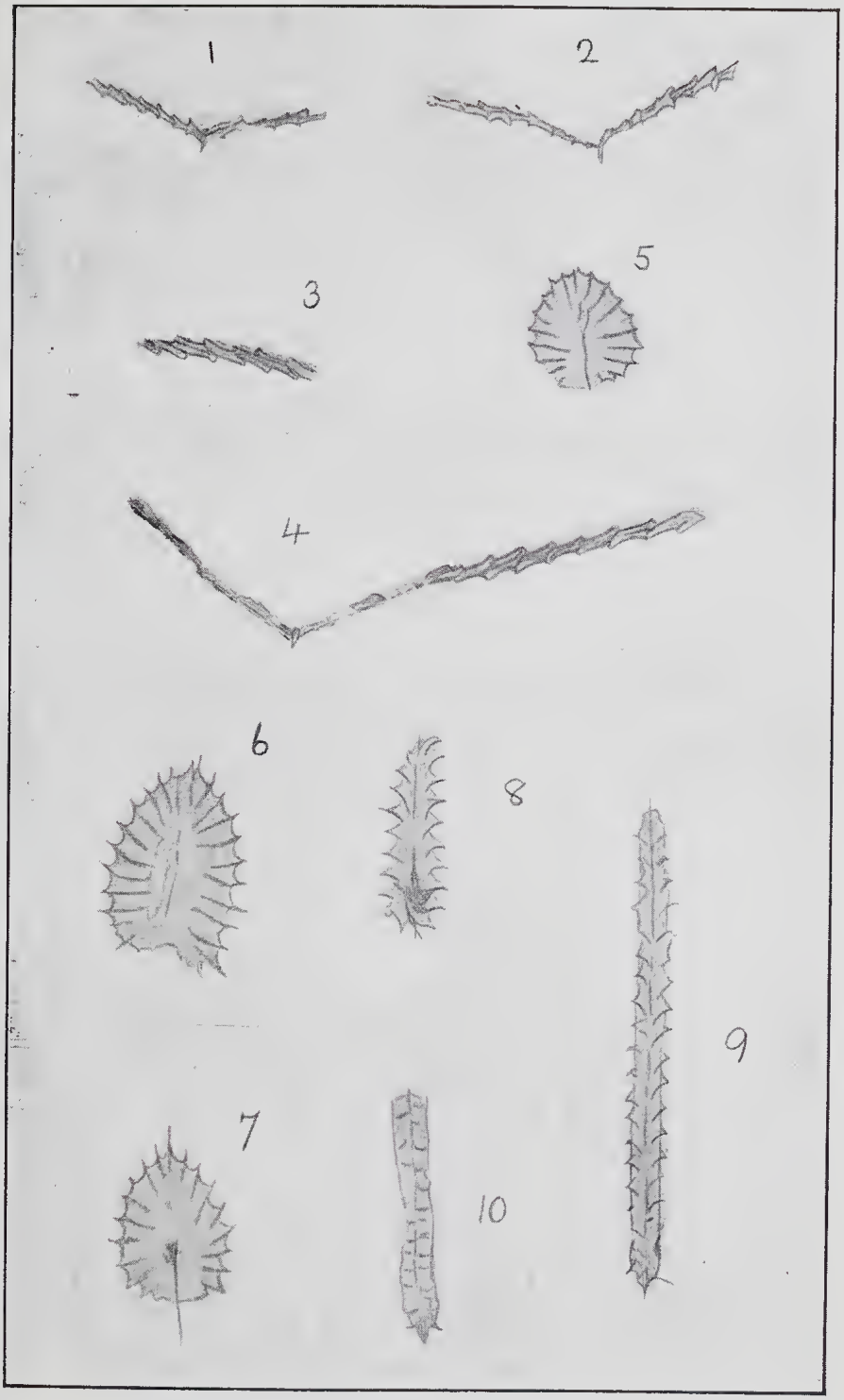
Fig. 4.—*D. nodosus*, sp. nov. Lower Ordovician (Darriwil). Bendigo East (No. 8 shaft, A. T. Woodward). [13356].

Fig. 5.—*Cardiograptus crawfordi*, sp. nov. Holotype. Lower Ordovician (Darriwil). Jackson's Creek, near the Pound, Gisborne. [13357].

Fig. 6.—*C. crawfordi*, sp. nov. Paratype. Lower Ordovician (Darriwil). Bendigo East. [13359].

Fig. 7.—*C. crawfordi*, sp. nov. Paratype, showing virgella. Lower Ordovician (Darriwil). Bendigo East. [13360].

*The numbers in brackets refer to registered specimens in the National Museum.



W.J.H. del.

Victorian Graptolites.